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Public Employees'
Retirement System
Actuarial Valuation
as of
July 1, 1990

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**Hendrickson, Miller
& Associates, Inc.**
ACTUARIAL CONSULTANTS

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Section I

Introduction

An actuarial valuation of the Public Employees' Retirement System of the State of Montana has been completed as of July 1, 1990. This valuation was authorized by the Public Employees' Retirement Board under Section 19-3-305, MCA. The purpose of the valuation was to determine the financial position of the fund, the normal cost, and the unfunded accrued liability based upon present and prospective assets and liabilities of the system as of July 1, 1990.

Section II presents an analysis of the results of the actuarial valuation. The numerical findings and membership data supporting this analysis are shown in Section III.


In conducting the actuarial valuation, certain assumptions were made as to the future experience of the system. A summary and discussion of each of the assumptions is contained in Section IV.

The valuation is based upon the Public Employees' Retirement Act and incorporates all amendments as of July 1, 1990. A summary of the major provisions of the Act is contained in Section V.

ACTUARIAL CERTIFICATION

The results of the actuarial valuation shown in this report are based upon information provided by the Public Employees' Retirement Division regarding plan participants, plan assets and other matters. The values have been calculated on the basis of actuarial assumptions which, in my opinion, are appropriate for purposes of this valuation.

This valuation has been prepared in accordance with generally accepted actuarial principles and practices and, to the best of my knowledge, fairly reflects the actuarial position of the Public Employees' Retirement System as of July 1, 1990.



Alton P. Hendrickson
Member, American Academy
of Actuaries

Section II

Analysis of Valuation

Results of Valuation

An actuarial valuation has been conducted as of July 1, 1990 for the Public Employees' Retirement System. This valuation has determined that the percent of each member's compensation required to fund the benefits as they accrue in the future is 10.22%. The aggregate contribution rate of 13.33% allows 3.11% of compensation to be applied toward the unfunded past service liability. This amount is sufficient to amortize the unfunded past service liability over a period of 21.76 years. The required funding period has decreased from 24.96 years in 1988.

A schedule has been prepared which will amortize the liabilities as of July 1, 1984, July 1, 1986, and July 1, 1988 over the remaining periods of 34 years, 36 years, and 38 years, respectively. The system had an actuarial gain -\$34,340,529 as of July 1, 1990, which will be amortized over a 40-year period. The total contribution rate required to meet this schedule is 12.42% of compensation. This is an increase over the 1988 rate of 11.65%. These rates are illustrated on Schedule 4.

Valuation of Assets

The improvement in the actuarial position of the Public Employees' Retirement System was due largely to the handling of the market value gain in assets. Prior to 1988, assets were based upon the cost value. In order to better recognize the actual financial position of the funds, the valuation now recognizes market value gain. To smooth the year to year fluctuations, each year's gain or loss is recognized over a six year period. This means that 1/6 of the gain or loss is recognized the first year, with an additional 1/6 recognized each year thereafter, until the full amount is recognized after six years. The table below illustrates this valuation:

Market Value as of 6/30/90	\$946,552,849
Cost Value as of 6/30/90	\$840,999,902
1990 Market Gain	5,856,083 x 1/6
1989 Market Gain	33,944,568 x 1/3
1988 Market Gain	-12,702,728 x 1/2
1987 Market Gain	-10,208,747 x 2/3
1986 Market Gain	52,838,361 x 5/6
Prior Market Gain	35,825,410

Adjusted Market Value	\$919,990,954

Benefit and Contribution Changes

The Public Employees' Retirement System formerly provided 50% of compensation after 30 years of service. This provision was changed on July 1, 1989 to allow 50% of compensation after 28 years. This change in the formula is the main reason that the normal cost increased from 9.38% in 1988 to 10.22% in 1990.

To fund the new benefit formula, an additional contribution of .983% of compensation has been implemented. This increased rate will be gradually implemented over the next 4 years. As a result of the new rate schedule, the aggregate contribution rate rose from 12.42% in 1988 to 13.33% in 1990.

A provision has been made to grant post-retirement benefit adjustments when investments earnings on assets allocated to retirees exceed the actuarially assumed rate. The amount available in 1989 was \$7,104,969. An amount of \$7,900,648 has been reserved in this valuation to provide benefits adjustments on January 1, 1991.

Actuarial Assumptions

The actuarial assumptions used in the valuation as of July 1, 1988 were continued in this valuation. A review of the system's data and experience did not reveal any deviations which warranted a change.

Summary of Data

The membership decreased during the biennium from 27,191 active members to 26,500, with 11,841 males and 14,659 females. The average age of the active members increased from 42 to 43. The average member was employed at age 35 and has completed 7 years of service.

The average annual compensation increased from \$17,145 to \$17,985. The total annual payroll is \$476,613,121.

The number of members receiving benefits grew from 9,224 in 1988 to 10,084 in 1990. The average retiree is age 71 and retired at age 60 with 18.4 years of service. The average retirement benefit is \$425, which increased from \$397 in 1988.

During the biennium, 1,127 members retired with an average benefit of \$557. Their average age was 61 years with 18.7 years of service.

Conclusion

Based upon the results of this valuation, the Public Employees' Retirement System is actuarially sound. The accrued liability of the system grew by \$185 million during the biennium. This was more than offset by a \$205 million increase in the system's assets. The cost of benefit improvements has been adequately funded through the scheduled contribution increases.

Section III

Schedule 1

Public Employees' Retirement System

Normal Cost Allocation

(1) Normal Cost Contribution Rate

(a) Retirement	7.21%
(b) Death	0.22
(c) Disability	0.35
(d) Vested	1.89
(e) Withdrawals	0.55

(f) Total Rate	10.22%

(2) Present Value of Future Salaries Of Current Members	\$3,398,660,998
(4) Present Value of Future Normal Costs For Current Members (1(f) * (2))	\$ 347,343,154

Schedule 2
Public Employees' Retirement System
Present Value of Benefits

(1) Present Value of Benefits - Inactive Members

(a) Retirement	\$ 402,334,186
(b) Death	11,571,712
(c) Disability	34,252,974
(d) Vested	19,096,851
(e) Withdrawals	3,391,955
(f) Benefit Adjustment	7,110,583

(g) Total Inactive	\$ 477,758,261

(2) Present Value of Benefits - Active Members

(a) Retirement	\$ 821,568,009
(b) Death	15,719,941
(c) Disability	24,561,184
(d) Vested	177,879,768
(e) Withdrawals	27,761,849

(f) Total Active	\$1,067,490,751

(3) Total Liabilities \$1,545,249,012

Schedule 3
Public Employees' Retirement System
Liability Allocation and Statutory Funding

(1) Unfunded Past Service Liability

(a) Present Value of Benefits	\$1,545,249,012
(b) Present Value of Future Normal Costs	\$ 347,343,154
(c) Fund Assets	\$ 919,990,954 -----
(d) Unfunded Liability (a)-(b)-(c)	\$ 277,914,904

(2) Contribution Rates Amortized over 21.76 Years

(a) Present Value of Salaries During Next 21.76 Years	\$ 8,936,168,711
(b) Unfunded Contribution Rate $1(d)/2(a)$	3.11%
(c) Normal Cost Rate (Schedule 1)	10.22 -----
(d) Statutory Funding Rate	13.33%

Schedule 4

Public Employees' Retirement System

Unfunded Liability Amortization Schedule

(1) Biennial Unfunded Past Service Liability Accounts

1984 Liability Account as of 7/1/88	\$ 324,842,208
Interest Charge on Liability Account	54,053,742
Contributions Applied to Liability	36,298,322
Interest Credit on Contributions	2,799,399
1984 Liability Account as of 7/1/90	\$ 339,798,229
1986 Liability Account as of 7/1/88	\$ -32,565,154
Interest Charge on Liability Account	-5,418,841
Contributions Applied to Liability	-3,638,876
Interest Credit on Contributions	-280,637
1986 Liability Account as of 7/1/90	\$ -34,064,482
1988 Liability Account as of 7/1/88	\$ 6,234,637
Interest Charge on Liability Account	1,037,444
Contributions Applied to Liability	696,667
Interest Credit on Contributions	53,728
1988 Liability Account as of 7/1/90	\$ 6,521,686

(2) Actuarial Gain/Loss

Current Unfunded Liability (Schedule 3)	\$ 277,914,904
Less 1984 Liability Account	339,798,229
Less 1986 Liability Account	-34,064,482
Less 1988 Liability Account	6,521,686

1990 Liability Account as of 7/1/90	\$ -34,340,529

(3) Required Contribution Rate

Normal Cost Rate (Schedule 1)	10.22%
Rate to Fund 1984 Liability Over 34 Years	2.64
Rate to Fund 1986 Liability Over 36 Years	-0.25
Rate to Fund 1988 Liability Over 38 Years	0.05
Rate to Fund 1990 Liability Over 40 Years	-0.24

Contribution Rate for 40-Year Schedule	12.42%

Schedule 5
Public Employees' Retirement System
Comparison of Valuations

	<u>1988</u>	<u>1990</u>
(1) Unfunded Past Service Liability		
(a) Present Value of Benefits	\$1,321,023,722	\$1,545,249,012
(b) Present Value of Future Costs	\$ 316,317,660	\$ 347,343,154
(c) Fund Assets	\$ 714,661,780	\$ 919,990,954
(d) Unfunded Liability	\$ 290,044,282	\$ 277,914,904
(2) Amortization Period and Contribution Rates		
(a) Years for Amortization	24.01	21.76
(b) Unfunded Contribution Rate	3.109%	3.11%
(c) Normal Cost Rate	9.308	10.22
(d) Statutory Funding Rate	12.417%	13.33%
(e) Amortization Schedule Rate*	11.561%	12.42%
(3) Active Members		
(a) Number of Members	27,033	26,500
(b) Annual Payroll	\$ 457,783,172	\$ 475,613,100
(c) Average Annual Salary	\$ 16,934	\$ 17,985
(4) Inactive Members		
(a) Number of Retired	8,366	9,042
(b) Number of Disabled	774	821
(c) Number of Survivors	205	221
(d) Number of Vested Deferred	370	830
(e) Annual Benefits	\$ 44,520,444	\$ 51,074,089
(f) Average Monthly Benefit	\$ 397	\$ 422

* Rate required to amortize each year's new liabilities over 40 years.

Schedule 6

Table 1

Public Employees' Retirement System

Number of Active Members

Years of Service	Member's Age									Total
	20-25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	OVER 60	
0-4	967	1809	2301	2461	2027	1316	862	614	402	12759
5-9	9	386	937	1169	1062	853	669	473	412	5970
10-14		28	434	875	752	609	530	419	374	4021
15-19			30	319	540	378	307	294	244	2112
20-24				8	139	240	212	197	167	963
25-29					3	108	124	107	73	415
30-34						6	76	67	42	191
35-39							6	26	23	55
40-UP								3	11	14
Total	976	2223	3702	4832	4523	3510	2786	2200	1748	26500

Table 2
Public Employees' Retirement System
Average Salaries of Active Members

Years of Service	Member's Age									Total
	20-25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	OVER 60	
0-4	12910	15192	15546	15357	15663	15146	15206	14801	13569	15116
5-9	15757	17886	18926	19332	19119	17334	16853	16217	15807	18078
10-14		19699	21068	23459	22650	20600	18330	18715	17244	20842
15-19			21966	23969	25941	24951	21967	20572	19603	23352
20-24				24059	27205	28049	24987	23748	20851	25092
25-29					25204	30004	28433	24493	22079	26685
30-34						29266	29896	28345	26841	28660
35-39							30888	30772	27264	29317
40-UP								31505	25315	26641
Total	12936	15717	17101	18369	19224	19044	18708	18519	17349	17985

Table 3
Public Employees' Retirement System
Number of Vested Inactive Members

Years of Service	Member's Age									Total
	20-25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	OVER 60	
0-4										
5-9		15	46	92	91	89	82	63	43	521
10-14		1	5	28	50	40	34	32	23	213
15-19				2	9	15	8	12	13	59
20-24					2	4	8	3	5	22
25-29						2	1	1	2	6
30-34							1	1	4	6
35-39								1	1	2
40-UP									1	1
Total		16	51	122	152	150	134	113	92	830

Table 4
Public Employees' Retirement System
Number of Retired Members

Member's Service	Recipient's Age									Total
	< 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Over 80	
0-4				1		10	25	28	20	84
5-9	3		32	55	217	407	444	257	112	1527
10-14	2		32	90	266	509	516	407	385	2207
15-19	3		18	71	265	407	390	293	258	1705
20-24	6		10	40	204	302	316	223	170	1271
25-29	5	6	37	57	143	187	181	130	102	848
30-34	1	14	71	146	199	211	163	74	108	987
35-39	4		1	13	45	67	68	48	76	322
40-UP	1			2	10	15	20	16	27	91
Total	25	20	201	475	1349	2115	2123	1476	1258	9042

Table 5
Public Employees' Retirement System
Average Benefits of Retired Members

Member's Service	Recipient's Age									Total
	< 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Over 80	
0-4				111		95	69	58	73	70
5-9	188		119	128	136	146	139	136	134	139
10-14	176		181	196	250	258	241	218	195	231
15-19	228		342	301	419	398	345	320	276	352
20-24	399		397	510	592	557	468	414	366	486
25-29	381	695	947	849	814	731	626	544	445	675
30-34	1203	1264	1290	1166	1005	904	803	646	512	917
35-39	520		1722	1418	1303	1237	950	823	633	984
40-UP	552			748	1558	1368	1332	1116	735	1126
Total	389	1093	737	642	532	450	380	330	313	425

Table 6
Public Employees' Retirement System
Number of Disabled Members

Member's Service	Recipient's Age									Total
	< 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Over 80	
0-4	6	4	4	3	2	11	14	12	6	62
5-9	41	19	40	49	39	50	14	17	20	289
10-14	16	13	14	25	52	31	25	18	27	221
15-19	10	5	10	36	19	20	18	10	7	135
20-24	1	6	7	13	12	12	8	5	7	71
25-29			2	6	12	3	5	1	5	34
30-34					1			1	5	7
35-39									2	2
40-UP										
Total	74	47	77	132	137	127	84	64	79	821

Table 7
Public Employees' Retirement System
Average Benefits of Disabled Members

Member's Service	Recipient's Age									Total
	< 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Over 80	
0-4	313	391	387	340	464	366	346	371	251	351
5-9	332	343	288	319	356	329	343	302	308	324
10-14	402	395	355	339	327	338	384	383	312	350
15-19	420	355	374	384	406	386	399	439	331	392
20-24	685	625	517	494	537	403	524	492	365	492
25-29			720	771	614	476	494	586	434	591
30-34					741			458	445	489
35-39									435	435
40-UP										
Total	362	399	349	379	395	354	394	381	332	372

Table 8
Public Employees' Retirement System
Number of Survivors

Member's Service	Recipient's Age									Total
	< 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Over 80	
0-4										
5-9	2		1	2	3	5	2			15
10-14	5			3	8	6	10	6	6	44
15-19	3		3	6	10	5	5	5	12	49
20-24	1	1			8	9	5	4	13	41
25-29		2	1	5	2	6	6	6	8	36
30-34			1	3	4	5	2	1	2	18
35-39					2	2		1	5	10
40-UP	2					2		1	3	8
Total	13	3	6	19	37	40	30	24	49	221

Table 9
Public Employees' Retirement System
Average Benefits of Survivors

Member's Service	Recipient's Age									Total
	< 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Over 80	
0-4										
5-9	158		304	158	232	182	267			205
10-14	256			334	259	267	285	287	276	277
15-19	308		277	467	478	388	394	350	322	385
20-24	327	416			575	515	365	442	367	447
25-29		851	400	1172	580	494	543	447	414	593
30-34			1616	1181	1279	824	1077	542	532	1009
35-39					1673	1415		950	535	980
40-UP	590					1057		1048	616	774
Total	310	706	525	712	588	528	420	436	392	488

Section IV

Actuarial Funding Method

The true cost of the Public Employees' Retirement System will be determined by its future experience. In determining the financial requirement of the fund, certain assumptions were made as to the expected future experience. This section summarizes the funding method applied as well as the basic assumptions used.

Any variations in the actual experience of the fund from those assumed in this valuation may cause changes in the projected future costs of the fund. It is therefore necessary that the actuarial assumptions be reviewed from time to time with adjustments as experience warrants. It is also important that regular valuations be performed to determine the financial effect of variations between the actual and assumed experience.

The assumptions shown below were based upon the past experience of the fund together with the projections as to future experience.

The method of funding employed is commonly referred to as the entry age normal cost method. This method establishes a normal cost of each fund as well as an unfunded accrued liability. The normal cost is the level percentage of total salaries required to fund the benefits, assuming this percentage has been contributed since each member's entry into the fund.

The unfunded accrued liability represents the excess of the present value of total liabilities over the present assets of the fund and the present value of expected future contributions for the normal cost.

In order to maintain the fund on an actuarially sound basis, the rate of contribution should be such as to meet the normal cost in addition to making progress towards the amortization of the unfunded liability.

Discussion of Actuarial Assumptions

Mortality Rates

The mortality rates for males and females are based upon the 1983 Group Annuity Mortality Table, and apply to both active members and those receiving benefits.

Disability Rates

The disability rates for males and females are based upon the 1983 Disability Table.

Withdrawal Rates

The withdrawal rates are based upon the actual experience of the system as determined in the 1987 withdrawal experience study.

Salary Scale

The rates of salary increase are based upon an assumed compounded growth rate of 6.5% per annum.

Investment Earnings

It was assumed that the investment earnings would be 8% compounded annually.

Administrative Expenses

It was assumed that the system would incur no administrative expenses beyond those provided by investment earnings in excess of 8% and the \$1 per member charge.

Termination Benefits

It was assumed that all members terminating with less than five years of service would receive an immediate withdrawal of their member contributions with interest. It was further assumed that members with five or more years of service would select the most advantageous benefits under the given assumptions.

Illustration of Actuarial Assumptions

Mortality Rates

The mortality rates are based upon the 1983 Group Annuity Mortality Table.

<u>Age</u>	<u>Deaths Per 10,000 Male Members</u>	<u>Deaths Per 10,000 Female Members</u>
25	5	3
30	6	3
35	9	5
40	12	7
45	22	10
50	39	16
55	61	25
60	92	42
65	156	71
70	275	124
75	446	240
80	741	429
85	1,148	699

Disability Rates

The disability rates are based upon the 1983 Disability Table.

<u>Age</u>	<u>Disabilities per 10,000 Male Members</u>	<u>Disabilities per 10,000 Female Members</u>
25	1	1
30	2	3
35	3	5
40	6	9
45	12	15
50	20	22
55	51	41
60	105	87

Withdrawal Rates

The withdrawal rates illustrated below reflect the turnover experienced by the Public Employees' Retirement System.

Age	Withdrawals Per 10,000	Withdrawals Per 10,000
	Male Members	Female Members
25	1,686	2,203
30	1,150	1,514
35	757	996
40	565	776
45	460	632
50	354	489
55	259	374
60	172	259

Salary Scale

The salary increases are based upon an assumed compounded growth rate of 6.5% per annum.

Investment Earnings

Future investment earnings are assumed to be 8% compounded annually.

Administrative Expenses

It was assumed that the administrative expenses would be recovered by investment earnings in excess of 8% in addition to the \$1 per member charge.

SECTION V

Summary of Benefits and Contributions

Effective Date -	July 1, 1945
Member Contributions -	<p>A percent of compensation as follows:</p> <p>6.30% as of July 1, 1990 6.417% as of July 1, 1991 6.55% as of July 1, 1992 6.70% as of July 1, 1993 and thereafter</p>
Employer Contributions -	<p>A percent of each active member's compensation as follows:</p> <p>6.417% as of July 1, 1990 6.417% as of July 1, 1991 6.55% as of July 1, 1992 6.70% as of July 1, 1993 and thereafter</p>
Retirement Benefit -	<p>Eligibility: Age 60 and 5 years of service; age 65 regardless of service; or 30 years of service regardless of age.</p> <p>Normal Form: Life annuity with a death benefit equal to the balance of accumulated deductions not received by the member as of the date of death (modified cash refund annuity).</p> <p>Benefit: 1/56 of the final compensation for each year of credited service. Contributing members of the System as of July 1, 1973 may retire under the benefit provisions in effect prior to that date (1/56 of the final compensation for each year of prior service plus twice the annuity purchased by the member's accumulated contributions with interest).</p>
Early Retirement Benefit -	<p>Eligibility: Age 50 and 5 years of service or 25 years of service regardless of age.</p> <p>Benefit: Actuarial equivalent of the accrued retirement benefit based upon a retirement age of 60.</p>

Disability Benefit -

Eligibility: 5 years of service and disablement before eligibility for service retirement.

Service disability: Members disabled prior to July 1, 1977 receive 25% of final compensation while Industrial Accident Board Compensation is in effect; otherwise, 50% of final compensation.

Nonservice disability: 90% of 1/56 of the final compensation for each year of credited service, with a minimum benefit of 25% of the final compensation.

Death Benefit -

Eligibility: Prior to retirement - no requirement. Certain specified terminated or disabled members are also eligible for this benefit.

After retirement - payable according to the option elected.

Normal Form: Return of accumulated contributions with interest if Industrial Accident Board Compensation is paid; otherwise return of accumulated contributions with interest plus 1/12 of final (last 12 months) compensation times number of years of credited service up to a maximum of 6 years.

Termination Benefit -

Prior to completion of 5 years of service, return of accumulated contributions with interest. After completion of 5 years of service, either return of accumulated contributions with interest or the actuarial equivalent of the accrued retirement benefit based upon a retirement age of 60.